

CLAIMS

1. A heat spreader comprising a layer of CVD diamond grown onto a diamond loaded (DL) material, the DL material comprising a mass of diamond particles in a matrix and having a surface with exposed diamond particles on which the layer of CVD diamond is grown, wherein the layer of CVD diamond is bonded to the exposed diamond particles of the DL material at least in part by epitaxy.
2. A heat spreader according to claim 1, wherein the layer of CVD diamond is continuous and without uncontrolled pits or holes.
3. A heat spreader according to claim 1 or claim 2, which exhibits substantial epitaxy at the interface between the layer of CVD diamond and the exposed diamond particles of the DL material.
4. A heat spreader according to claim 3, wherein the epitaxy covers an area of the interface exceeding 30%.
5. A heat spreader according to claim 4, wherein the epitaxy covers an area of the interface exceeding 50%.
6. A heat spreader according to claim 5, wherein the epitaxy covers an area of the interface exceeding 60%.
7. A heat spreader according to claim 6, wherein the epitaxy covers an area of the interface exceeding 70%.
8. A heat spreader according to claim 1 or claim 2, wherein the grown layer of CVD diamond has an exposed surface with at least 30% of the exposed surface being occupied by diamond grains with a grain size of at least four times the thickness of the layer of CVD diamond.

9. A heat spreader according to claim 8, wherein the diamond grains occupy at least 50% of the exposed surface of the layer of CVD diamond.
10. A heat spreader according to claim 9, wherein the diamond grains occupy at least 60% of the exposed surface of the layer of CVD diamond.
11. A heat spreader according to claim 10, wherein the diamond grains occupy at least 70% of the exposed surface of the layer of CVD diamond.
12. A heat spreader according to claim 1 or claim 2, wherein the layer of CVD diamond comprises epitaxial diamond grains that provide at least 30% of the volume of the layer of CVD diamond.
13. A heat spreader according to claim 12, wherein the epitaxial diamond grains provide at least 50% of the volume of the layer of CVD diamond.
14. A heat spreader according to claim 13, wherein the epitaxial diamond grains provide at least 70% of the volume of the layer of CVD diamond.
15. A heat spreader according to any one of the preceding claims, wherein the DL material is provided in the form of a layer with the layer of CVD diamond being grown on a major surface of the layer of DL material.
16. A heat spreader comprising a layer of DL material having major surfaces on each of opposite sides thereof, and a layer of CVD diamond in thermal contact with each of the major surfaces, with either one or both of the CVD diamond layers being bonded at least in part by epitaxy to exposed diamond particles of the DL material.

17. A heat spreader according to any one of the preceding claims, wherein the bonding by epitaxy between the layer(s) of CVD diamond and the exposed diamond particles of the DL material is deliberately enhanced over that which might occur naturally using untreated DL material.
18. A method of manufacturing a heat spreader includes the steps of providing a diamond loaded (DL) material comprising a mass of diamond particles in a matrix and having an exposed surface with exposed diamond particles, growing a layer of CVD diamond onto the exposed surface of the DL material such that it is bonded to the exposed diamond particles at least in part by epitaxy, wherein the exposed surface of the DL material is treated prior to growing the layer of CVD diamond thereon, thereby to enhance the epitaxy over that which would otherwise occur naturally using untreated DL material.
19. A method according to claim 18, wherein the exposed surface of the DL material is treated by a lapping process.
20. A method according to claim 19, wherein the lapping process is arranged to remove existing pitting, minimise further surface pitting and maximise the surface area of the exposed diamond particles present in the exposed surface of the DL material suitable for epitaxy.
21. A method according to claim 20, wherein the surface pitting is removed and further pitting minimised by controlling the diamond particle size distribution in the lapping process.
22. A method according to claim 21, wherein the lapping process is carried out in such a manner as to ensure that the largest diamond particles are not more than 20% or 15 μm larger, whichever is the

most restrictive, than the mean particle size of the diamond particles in the exposed surface of the DL material.

23. A method according to claim 22, wherein the largest diamond particles are not more than 10% or 10 μm larger, whichever is the most restrictive, than the mean particle size of the diamond particles in the exposed surface of the DL material.
24. A method according to any one of claims 18 to 23, wherein the layer of CVD diamond is continuous and without uncontrolled pits or holes.
25. A method according to claim 18 or claim 24, which exhibits substantial epitaxy at the interface between the layer of CVD diamond and the exposed diamond particles of the DL material.
26. A method according to claim 25, wherein the epitaxy covers an area of the interface exceeding 30%.
27. A method according to claim 26, wherein the epitaxy covers an area of the interface exceeding 50%.
28. A method according to claim 27, wherein the epitaxy covers an area of the interface exceeding 60%.
29. A method according to claim 28, wherein the epitaxy covers an area of the interface exceeding 70%.
30. A method according to claim 18 or claim 24, wherein the grown layer of CVD diamond has an exposed surface with at least 30% of the exposed surface being occupied by diamond grains with a grain size of at least four times the thickness of the layer of CVD diamond.

31. A method according to claim 30, wherein the diamond grains occupy at least 50% of the exposed surface of the layer of CVD diamond.
32. A method according to claim 31, wherein the diamond grains occupy at least 60% of the exposed surface of the layer of CVD diamond.
33. A method according to claim 32, wherein the diamond grains occupy at least 70% of the exposed surface of the layer of CVD diamond.
34. A method according to claim 18 or claim 24, wherein the layer of CVD diamond comprises epitaxial diamond grains that provide at least 30% of the volume of the layer of CVD diamond.
35. A method according to claim 34, wherein the epitaxial diamond grains provide at least 50% of the volume of the layer of CVD diamond.
36. A method according to claim 35, wherein the epitaxial diamond grains provide at least 70% of the volume of the layer of CVD diamond.
37. A method according to any one of claims 18 to 36, wherein the DL material is provided in the form of a layer and the layer of CVD diamond is grown on a major surface of the layer of DL material.
38. A method according to claim 37, wherein opposed layers of CVD diamond are grown on respective opposed major surfaces of the layer of DL material, either one or both of the layers of CVD diamond being bonded at least in part by epitaxy to expose diamond particles of the DL material.